Stoller
Grand Junction Office established 1959

GJO-2004-566-TAC

C4228
Log Data Report

Borehole Information:

Borehole: C4228			Site: 216-U-12 Crib		
Coordinates (WA State Plane)		GWL (ft)[1]: Dry		GWL Date: 01/26/2004	
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
Not Available	Not Available	Jan. 2004	Not Available	50	Push Hole

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded steel	1.4	6 5/8	5 5/8	1/2	1.4	50
The logging engineer measured a sample of casing located in a lay-down area next to the borehole. Outside casing diameter was measured using a caliper. The measurements were rounded to the nearest 1/16 in.						

Borehole Notes:

This push-hole is located at the 9 o'clock position about 19 ft west of the 216-U-12 Crib boundary. Zero reference is the ground surface.

Logging Equipment Information:

Logging System:	Gamma 1E		Type: SGLS (70%) 34TP40587A
Calibration Date:	01/2004	Calibration Reference:	GJO-2004-568-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 / Repeat			
Date	01/27/03	01/27/03			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	48.5	42.5			
Finish Depth (ft)	0.5	36.0			
Count Time (sec)	100	100			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
ft/min	N/A[3]	N/A			
Pre-Verification	AE071CAB	AE071CAB			
Start File	AE072000	AE072049			

Log Run	1	2 / Repeat			
Finish File	AE072048	AE072055			
Post-Verification	AE074CAA	AE074CAA			
Depth Return Error (in.)	0	0			
Comments	No fine-gain adjustment.	Repeat section			

Logging Operation Notes:

Zero reference was ground surface. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118. Logging started at the nearest 0.5-ft interval after reaching total depth. Maximum logging depth achieved was 48.5 ft.

Analysis Notes:

Analyst:	Sobczyk	Date:	1/28/04	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. All of the verification spectra were within the acceptance criteria. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 0.3 percent lower and 2.7 percent higher at the end of the day. Examinations of spectra indicate that the detector functioned normally during logging, and the spectra are accepted.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G1EJan04.xls). Zero reference was the ground surface. Based on the field measurements, the casing configuration was assumed as one string of 6-in. casing with a thickness of 1/2 in. to 48.5 ft (total logging depth). The dead time correction is applied when the dead time exceeds 10 percent. A water correction was not required.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{238}U and ^{235}U were the man-made radionuclides detected in this borehole. ^{238}U, based on the 1001-keV photopeak, was detected in the interval between 32.5 and 41.5 ft with concentrations ranging from 17 to 61 pCi/g. The maximum concentration was measured at 40 ft. ^{238}U was also detected at 24.5 ft with a concentration of 23 pCi/g, which is above the MDL (10 pCi/g). Photopeaks at 1001 keV were apparent at 23.5 and 25.5 ft. However, the APTEC software did not identify these photopeaks as being statistically

significant. ^{235}U, based on the 186-keV photopeak, was detected in the interval between 31.5 and 40.5 ft with concentrations ranging from 2.1 to 3.8 pCi/g. The maximum ^{235}U concentration was measured at 33.5 ft. The MDL for ^{235}U was approximately 1.5 pCi/g.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides at energy levels of 609, 1461, 1764, and 2614 keV and for ^{238}U at 1001 keV. ^{235}U, based on the 186-keV photopeak, did not repeat at 38.5 and 39.5 ft because the concentrations are near MDL.

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[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable

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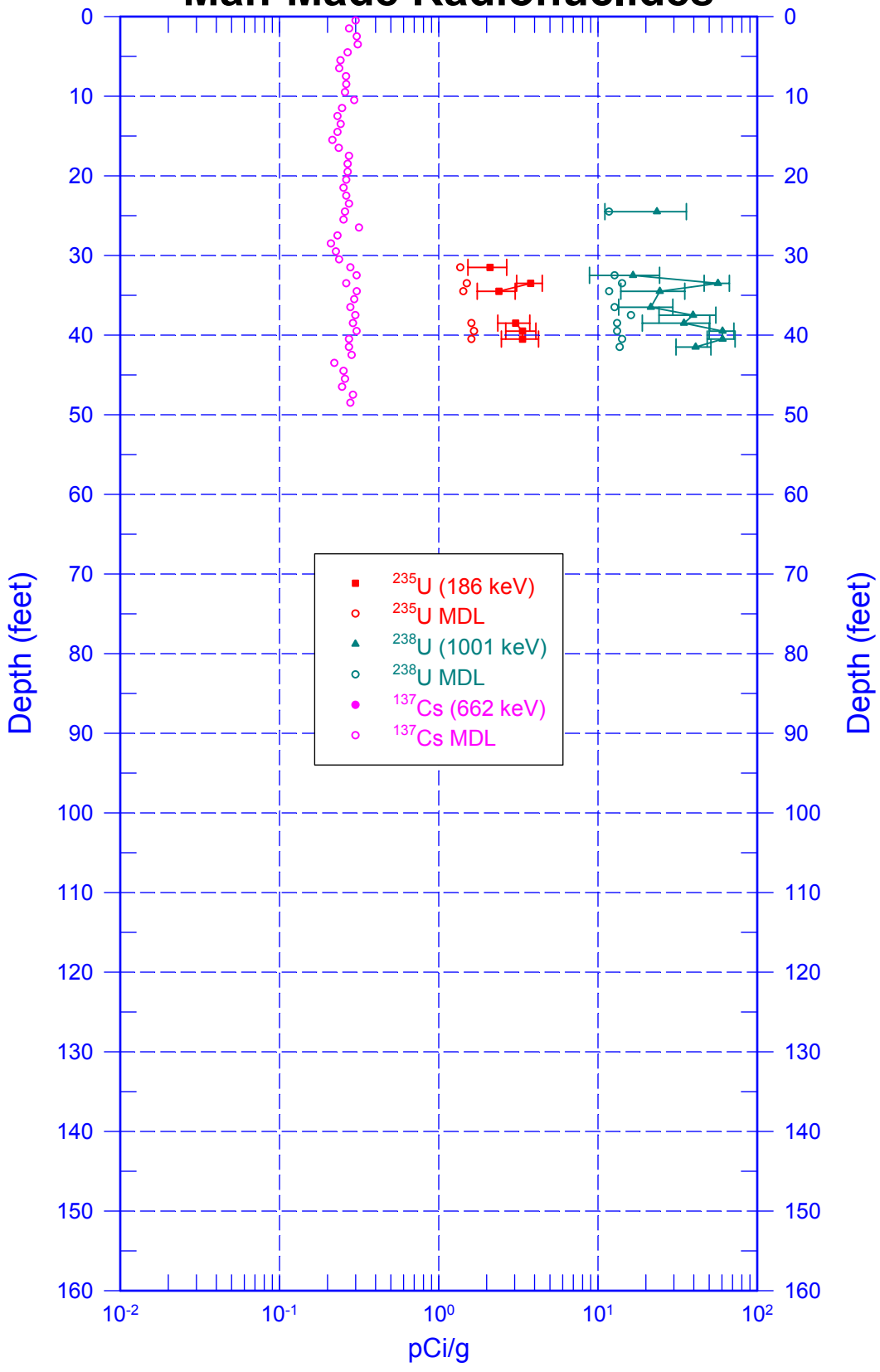
Man-Made Radionuclides



Zero Reference = Ground Surface

Date of Last Logging Run
1/27/2004

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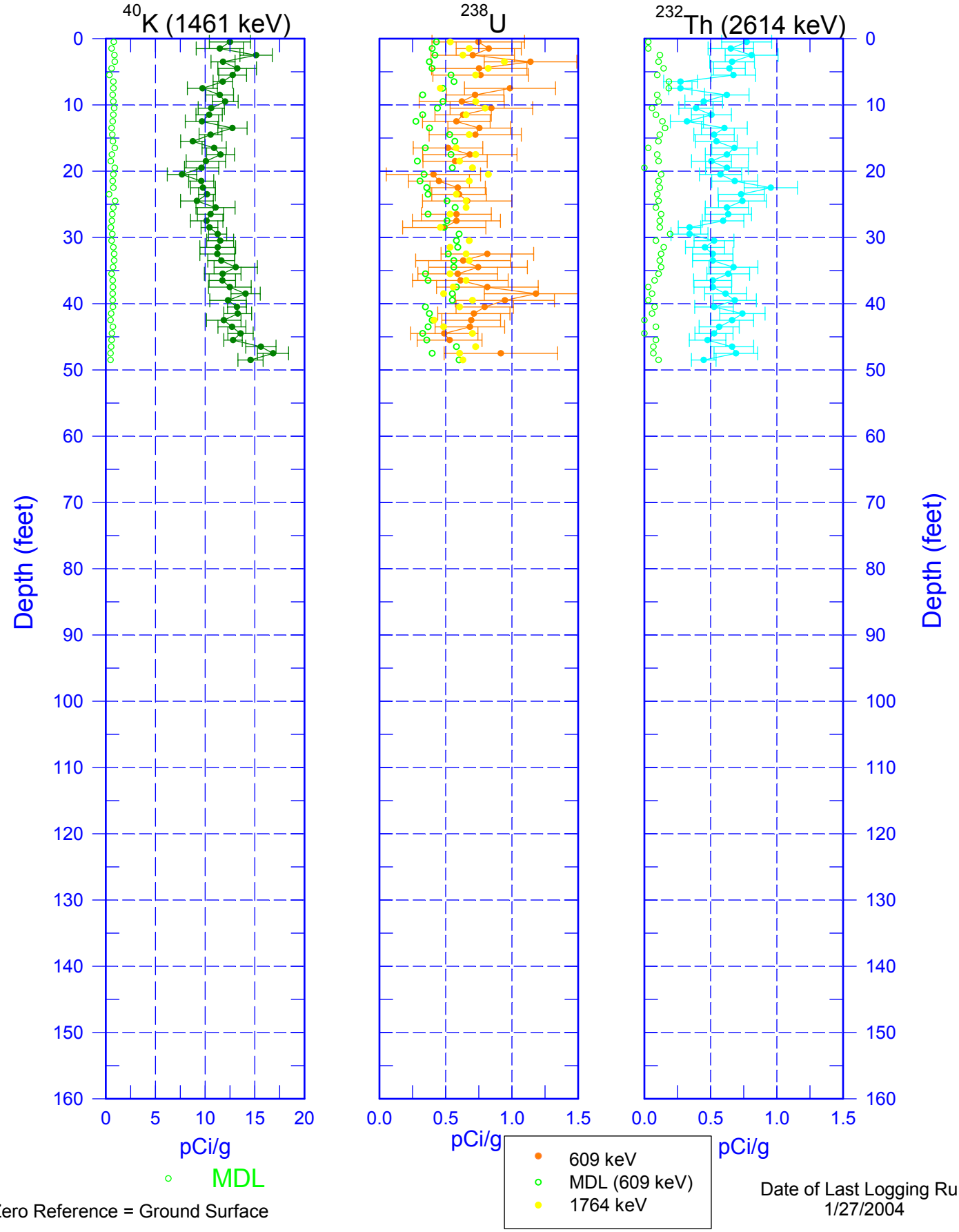
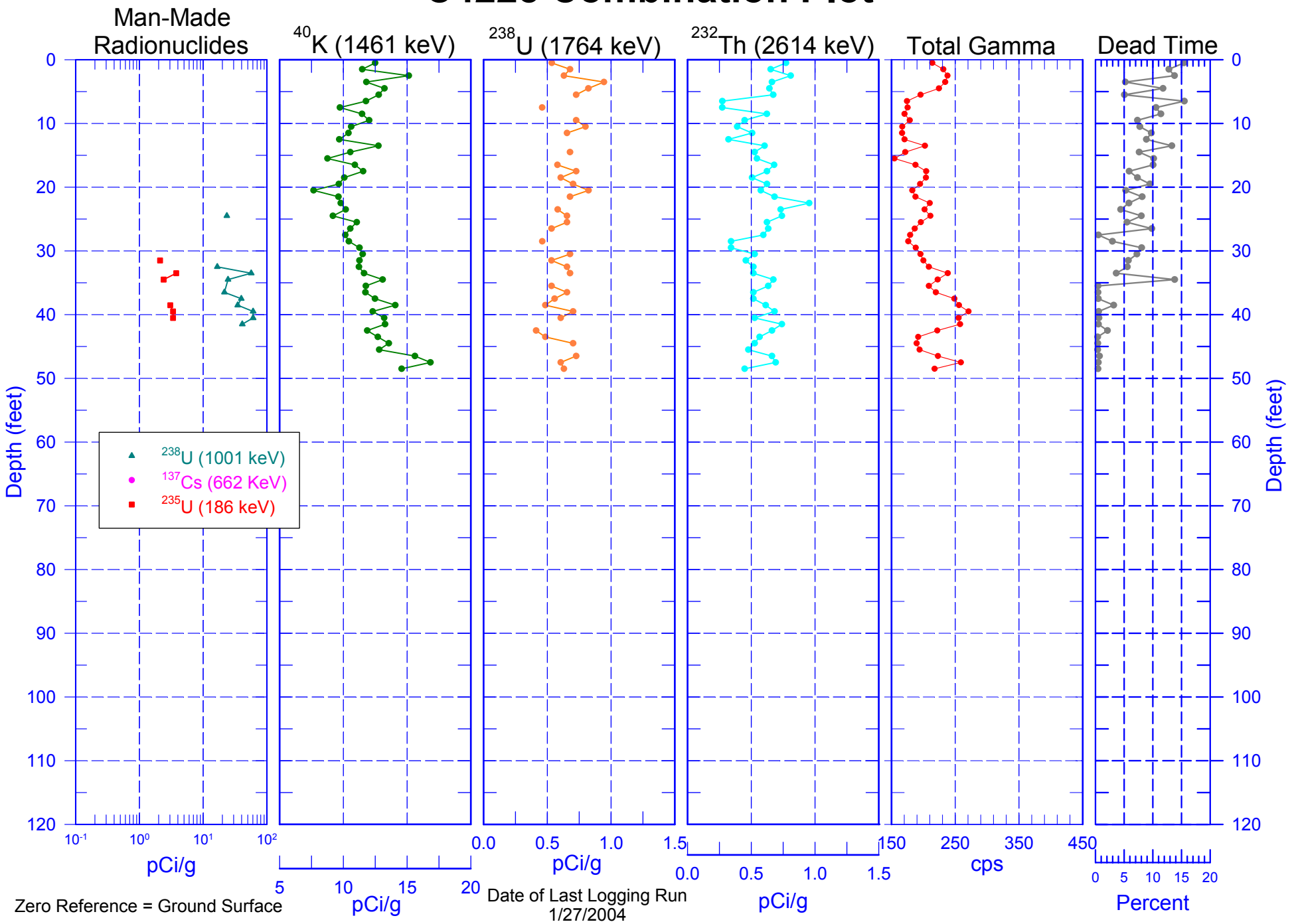
Natural Gamma Logs



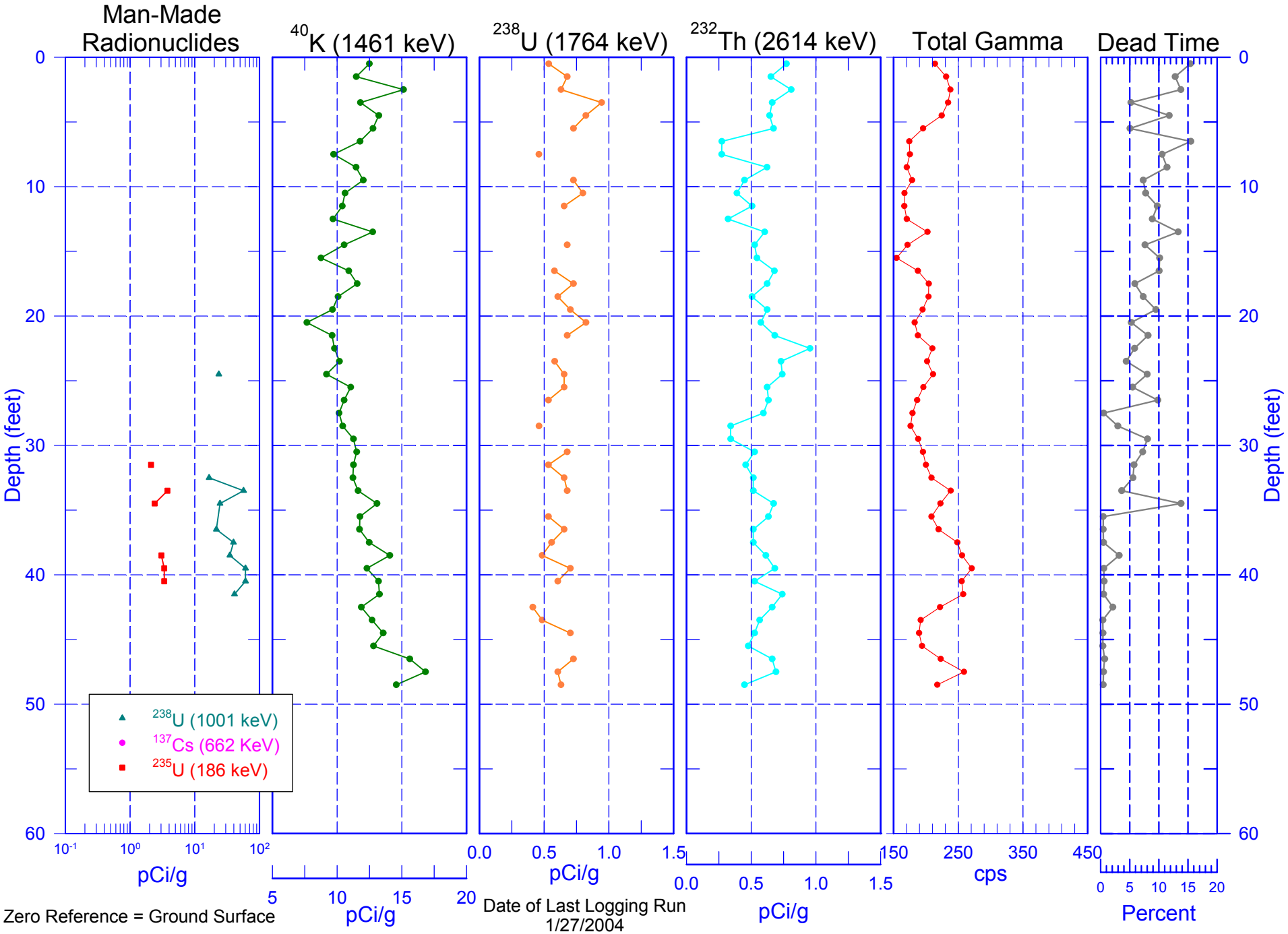
Zero Reference = Ground Surface

Date of Last Logging Run
1/27/2004

C4228 Combination Plot



C4228 Combination Plot



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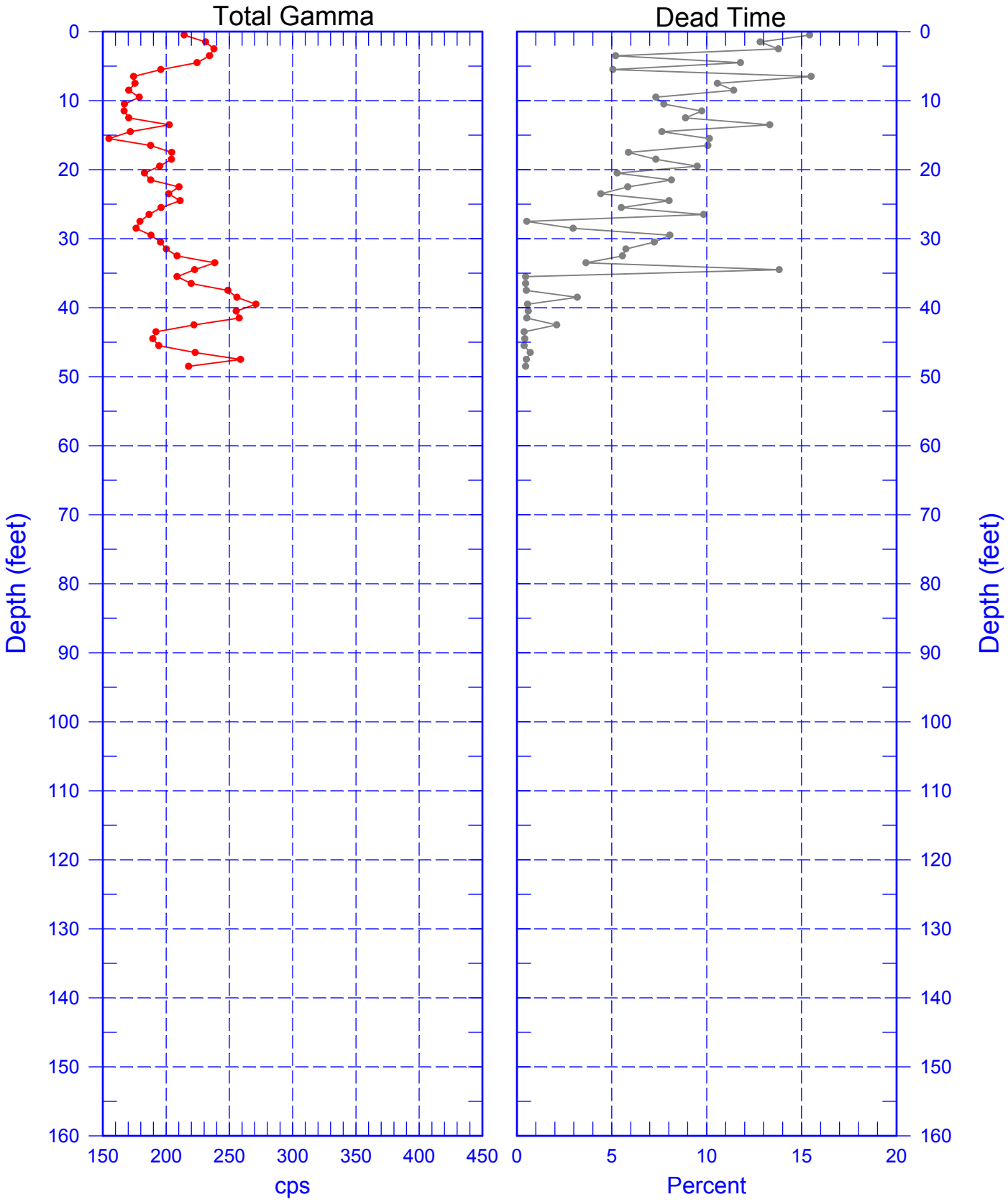
Total Gamma & Dead Time



Zero Reference = Ground Surface
Date of Last Logging Run
1/27/2004

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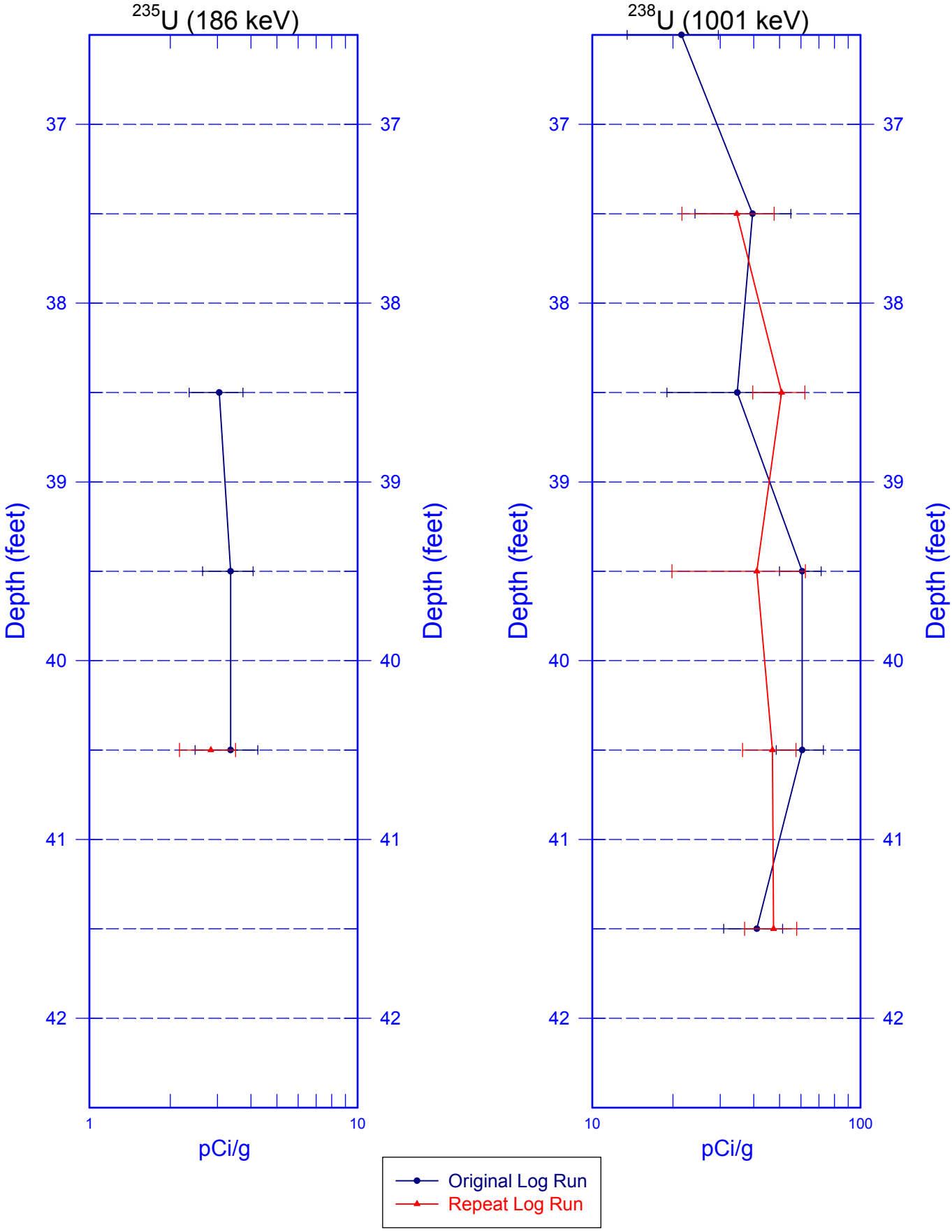
Rerun of Man-Made Radionuclides



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Rerun of Natural Gamma Logs (42.5 to 36.5 ft)